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Author(s)	Tanaka, Otohiko
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THE PELAGIC COPEPODS OF THE IZU REGION, MIDDLE JAPAN SYSTEMATIC ACCOUNT I.

FAMILIES CALANIDAE AND EUCALANIDAE

OTOHIKO TANAKA

Fisheries Department, Faculty of Agriculture, Kyushu University

With 5 Text-figures

The report had in the original manuscript the following contents: Introduction, Material and method, List of stations and date of collection, List of species, Systematic account, Zoogeographical and vertical distribution of the species, and Reference list. The first three chapters have been published in the journal "Records of Oceanographic Works in Japan, New Series, vol. I, no. 1, pp. 124-137, 1955." The present paper deals only with the Systematic account and forms Part I of the series which will be appeared continually in this journal. The present study was completed in 1948, but owing to publication difficulties the appearance of the paper was delayed much.

Systematic Account

Family CALANIDAE

Genus *Calanus* LEACH, 1819

The genus *Calanus* (sensu lato) has often been reduced by the separation of a number of species to other genus. At present the following genera are represented in the family Calanidae: *Calanus* LEACH, *Calanoides* BRADY, *Canthocalanus* A. SCOTT, *Neocalanus* G. O. SARS, *Megacalanus* WOLFENDEN, *Bathycalanus* G. O. SARS, *Undinula* A. SCOTT and *Nannocalanus* G. O. SARS.

These genera resemble so closely one another in general appearance that some of the authors still include them in the genus *Calanus*. *Calanus finmarchicus* (GUNNERUS) is regarded as the type of the genus *Calanus*. The generic characteristics of *Calanus* in the restricted sense are as follows: Head is, in most cases, separate from the 1st thoracic segment; the 4th is separate from the 5th; the rostrum consists of two slender filaments; the 1st antenna and mouth parts are of normal structure; the 1st to 4th legs with 3-jointed exopodite and endopodite; the distal joint of the exopodite of the 1st to 4th legs with two outer marginal spines; the male 5th pair of legs have general

resemblance to those of the female, but the left leg is slightly modified in shape and armature.

Six species belonging to the genus *Calanus* (sensu stricto) have been recorded from the neighbouring waters of Japan: *C. finmarchicus* (GUNNERUS), *C. hyperboreus* KRÖYER, *C. tenuicornis* DANA, *C. cristatus* KRÖYER, *C. minor* (CLAUS) and *C. plumchrus* MARUKAWA. The last one has been reported from the northern water and is very closely allied to *C. tonsus* BRADY, some author distinguishes the species from the typical *tonsus* under a variety name, *C. tonsus* var. *plumchrus*. *C. hyperboreus* KRÖYER has been recorded from the Japan Sea by MARUKAWA, but I have not met with the species in the Izu region.

Calanus finmarchicus (GUNNERUS)

(Fig. 1, a-j)

C. finmarchicus GIESBRECHT, 1892, p. 89, t. 6, 7, 8; G. O. SARS, 1903, p. 11, pl. 4; ESTERLY, 1905, p. 125; WITH, 1915, p. 10; FARRAN, 1929, p. 212; WILSON, 1932, p. 23; *C. helgolandicus*, WILSON, 1932, p. 25; *C. finmarchicus*, JESPERSEN, 1934, p. 10; MORI, 1937, p. 13, pl. 2; *C. helgolandicus*, MORI, 1937, p. 14, pl. 1; *C. finmarchicus* SEWELL, 1947, p. 13; MARSHALL and ORR, 1955, p. 1; *C. helgolandicus*, MARSHALL and ORR, 1955, p. 4.

It has been noticed by many authors that there are two size groups in *C. finmarchicus*. According to SARS the large specimen is *C. finmarchicus*, and the small specimen *C. helgolandicus*. The size given by the authors are as follows:

	Female, Length (mm)	Male, Length (mm)
GIESBRECHT	2.7-4.5	2.35-3.2
G. O. SARS	about 4.0	3.60
	(about 3.0	2.80 <i>helgolandicus</i>)
WITH	2.8-5.5	3.0-4.0
FARRAN	2.64-3.2	
JESPERSEN	3.5-4.5 (large size)	
	2.4-4.5 (small size)	
MORI	about 4.0-5.0	about 3.6
	(about 3.0	about 2.8 <i>helgolandicus</i>)

The specimen of the Izu region measured:

3.5-4.07 (large size)	3.0-3.7
2.38-3.10 (small size)	2.45-2.80

SARS (1903) described a species of *Calanus* which he thought to be identical with the specimen reported by CLAUS under the name *Cetochilus helgolandicus*. He pointed out that the specimen differs from *C. finmarchicus* in its size, the proportional length of the furcal ramus, and in the structure of the male 5th legs.

The specimens of the Izu region, so far as I have examined, can be divided into

two size groups. These forms are found commonly in the surface and intermediate layers. The large form has the forehead more evenly rounded; the proportional lengths of the metasome to urosome 3.8:1; the furcal rami about 1.3 times as long as wide. In the small form the head is more produced and narrowly rounded; the proportional lengths of the metasome to urosome are 3.6:1; the furcal rami about 1.4 times as long as wide. The male of the small form has the left 5th leg with a

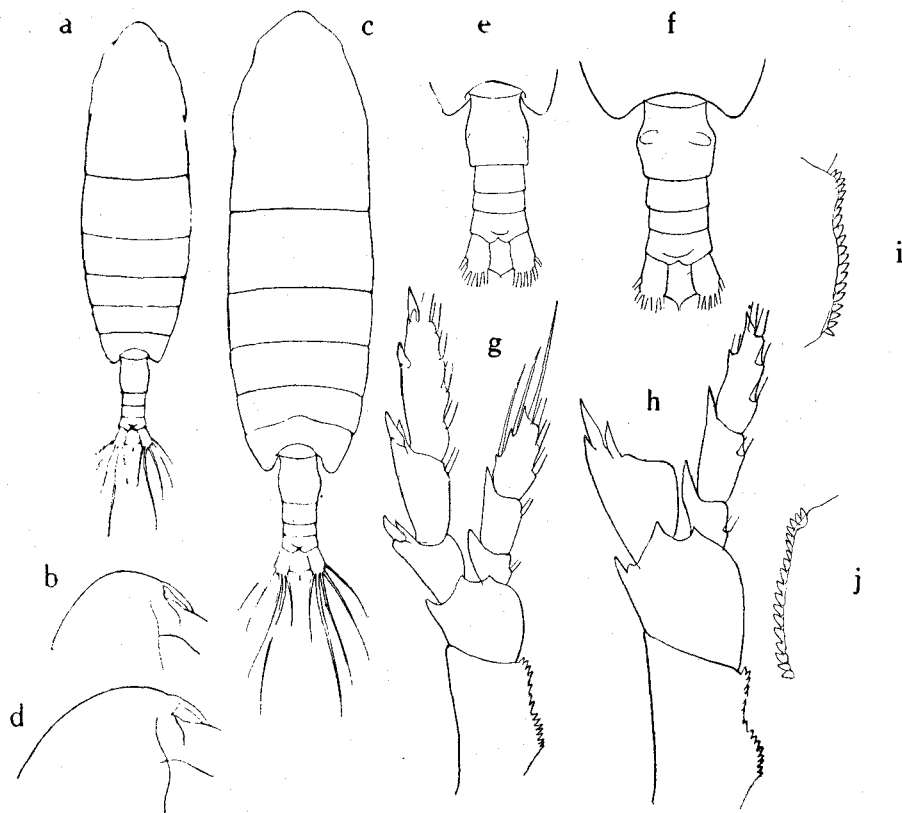


Fig. 1. *Calanus finmarchicus* (GUNNERUS).

a, Female: small specimen, dorsal aspect; b, head, lateral aspect; c, large specimen, dorsal aspect; d, head, lateral aspect; e, abdomen, dorsal (specimen 2.4 mm); f, abdomen, dorsal (specimen 2.9 mm); g, 5th leg (2.4 mm); h, 5th leg (2.9 mm); i, left inner margin of 1st basal joint of 5th leg (3.78 mm); j, right inner margin of 1st basal joint of 5th leg (3.78 mm).

slender exopodite than that of the large form. These differences are quite similar to those found in the specimens of the European waters. One could have, if he wishes, regarded the small form as *C. helgolandicus*, and the large as *C. finmarchicus*. MARSHALL and ORR (1955) report that there are two forms also in the Plymouth and Clyde sea area, though *helgolandicus* is larger than *finmarchicus* in those areas.

It has been reported that the size of *C. finmarchicus* shows a remarkable regional and seasonal variation. According to BOGOROFF the copepods grow larger in cold waters than in the warm. He shows as an example:

Locality	Average total length (mm)	Temperature °C
69°30' N-75°N	3.22	4.6
75° N-77°N	3.78	1.08
North of 77°N	4.57	

JESPERSEN gives the following example:

Eastern North Sea	ca. 1.9-2.7 mm
West Greenland water	2.4-4.5

RUSSELL (1935) shows that in Plymouth area there are three main breeding seasons, and each brood differs in size. The individuals of the first brood during the cold period of the year grow to the largest, thereafter the remaining broods decrease in size as the temperature rises. The seasonal variation in size of the adult in the Izu region are as follows:

Month	Total length (mm)	
	Female	Male
December, 1936	2.38-3.01	2.56-2.98
February, 1937	3.75-3.86	
March, 1937	3.65-3.80	
April, 1937	4.03	3.49-3.70
June, 1937	2.80-2.90	

These two forms have each different habit in the vertical distribution; the small predominates in the upper layer down to 200 m, whereas the large in the layer deeper than 200 m; the immature specimens of the large form were found below 400 m in the month October 1937. The temperature of the 200 m layer was about 12°C, and that of the 400 m was about 8°C respectively. MORI reported that he has obtained only a single specimen of *C. finmarchicus*, but plenty of *helgolandicus* from Japanese waters. It can be attributed to the fact that he has collected only in the upper layer less than 200 m in the warm sea area.

As above mentioned, *C. finmarchicus* varies in size according to the conditions of life. The proportional lengths of the metasome to urosome show some individual difference. But there are some minute points of difference between these two forms. For instance, the inner margin of the 1st basal joint of the 5th legs of the female is straight or slightly convex in *finmarchicus*, whereas it is concave in *helgolandicus*. These two forms are, indeed, distinguishable, but there is no sufficient ground to raise the small form to the rank of species. Here I propose to separate the specimen with produced head from the specimen with evenly rounded head under a variety name *C. finmarchicus* var. *helgolandicus*.

Female. Length, large form, 3.50-4.07 mm. The abdomen is contained 3.6-4.1

times in the length of the cephalothorax; the genital segment is wider than long (36:32); the furcal rami about 1.3 times as long as wide (16:12); the 1st antenna extends to the end of the furca; the inner margin of the 1st basal joint of the 5th leg had is straight or slightly convex, and had 20 to 22 teeth.

The small form measured 2.38–3.10 mm; the cephalothorax narrow when viewed from the dorsal; the head is more produced; the abdomen is contained 3.5–4.2 times in the length of the cephalothorax; the genital segment is longer than wide (23:21–22); the furcal rami 1.4 times as long as wide (11:8); the 1st antenna exceeds the end of the furca by terminal two joints; the inner margin of the 1st basal joint of the 5th leg is straight or slightly concave, and had 14 to 22 teeth. The small specimen measured 2.90 mm had only five setae on the distal joint of endopodite of 5th pair of legs.

Male. Length. The large form, 3.49–3.70 mm; the small form, 2.50–2.98 mm; both forms have the 5th pair of legs of the similar structure except that the small form has the exopodite in the right leg reaching the proximal one-third of the 2nd joint of the exopodite of the left leg, whereas the large has the exopodite reaching the middle of the 2nd joint of the exopodite of the left leg.

Occurrence. Two forms are found commonly in the Izu region. The small form abundant in the upper layer, and the large predominates in the deeper layers.

Distribution. The species has a wide distribution in all oceans.

Calanus tenuicornis (DANA)

Calanus tenuicornis GIESBRECHT, 1892, p. 90. t. 6, 7, 8; A. SCOTT, 1909, p. 9; FARRAN, 1929, p. 217; SEWELL, 1929, p. 20; FARRAN, 1936, p. 77; MORI, 1937, p. 16, pl. 3, 4; VERVOORT, 1947, p. 22.

SARS included this species along with *C. gracilis* DANA and *C. robustus* GIESBRECHT in his proposed genus *Neocalanus*. But the absence of the hook on the 2nd basal joint of the 1st leg, and the fact that the head and the 1st thoracic segment are separate in this species, whereas in *gracilis* and *robustior* they are fused, are the sufficient grounds for separating the present species from the other too.

Length. Female, 1.99–2.10 mm. Male, 1.77 mm.

Occurrence. Three adult female and two males in a vertical haul from the depth 1000 m to the surface in Suruga Bay. The species appears to be rather a deep water species. It has been seldom obtained from the surface in the Izu region.

Distribution. The species is widely distributed in the tropical and subtropical regions of the Pacific, Atlantic and Indian Oceans.

Calanus plumchrus MARUKAWA

(Fig. 2, a–d)

C. plumchrus MARUKAWA, 1921, p. 10, pl. 1; *C. sp.* SATO, 1913, p. 3, pl. 2.
C. tonsus CAMPBELL, 1930, p. 177; TANAKA, 1954, p. 29, figs. 1–4.

C. tonsus MARSHALL and ORR, 1955, p. 8.

C. plumchrus TANAKA, 1956, p. 49, figs. 1-4.

Calanus tonsus BRADY was described by BRADY from the material taken in the southeast coast of the Australia (lat. $34^{\circ}8'$) and the east coast of South America (lat. $42^{\circ}43'$ S.). The species was also recorded by BRADY between Yokohama and Sandwich Island (Lat. $35^{\circ}41'$ N.). FARRAN recorded the species at stations off New Zealand between lat. 30° - 40° S. and lat. 50° - 60° S. WILSON recorded it from the

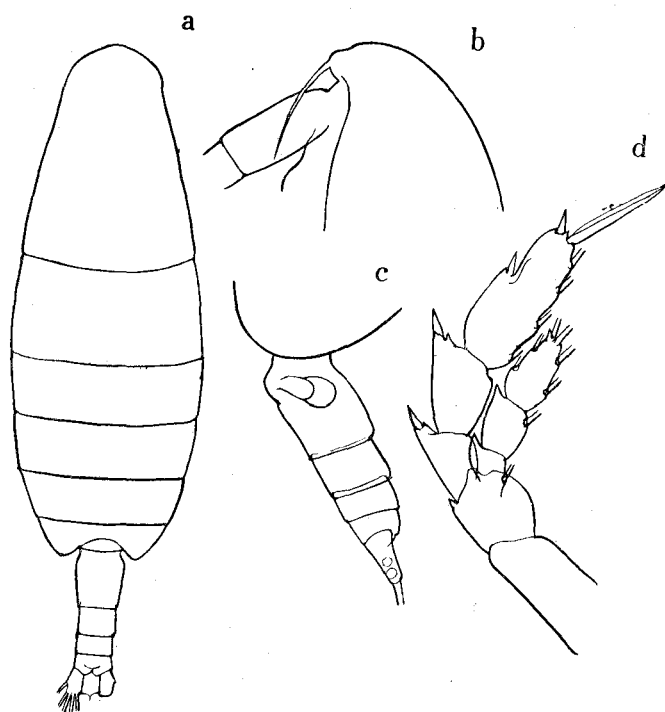


Fig. 2. *Calanus plumchrus* MARUKAWA.

a, Female, dorsal aspect; b, head, lateral aspect; c, abdomen, lateral aspect; d, 5th leg,

Woods Hole region. The occurrence of the species in the northern Pacific was reported by JOHNSON (1932), CAMPBELL (1934), TANAKA (1954), VINOGRADOV (1955), and BRADSKY (1955).

Recently Mr. J. NAKAI of the Tōkai Regional Fisheries Laboratory has informed me by personal communication that the original specimen of *C. tonsus* BRADY is not identical with the specimen from the northern Pacific. He says that the specimen from the southern hemisphere is smaller in size, and has the 2nd to 5th swimming legs which are furnished with small spines on the inner distal margin of the 2nd

basal joint; the proportional lengths of the proximal and distal outer margin of the 3rd joint of the exopodite divided by the outer marginal spine in the 2nd to 4th legs are different from those found in the northern specimen. These characters were mentioned by F. DAHL (1894) and by N. WOLFENDEN (1908) but not by BRADY. He must have overlooked these characters or examined the specimen which has no such characters. Accordingly there are forms in *C. tonsus* BRADY. In my previous paper I have made no distinction between the northern and southern specimens. Russian zoologists are of opinion that these forms are not distinct. MARSHALL and ORR (1955) distinguished the northern form from the southern one under a variety name *C. tonsus* var. *plumchrus*, but it is not clear upon whose reference they have made the distinction. NAKAI insists on the validity of *C. plumchrus* MARUKAWA. Recently I had an opportunity to examine the Antarctic specimen of *C. tonsus* BRADY. On comparing the specimen with that of the North Pacific, these two specimens are not identical. The specimen of the Antarctic is *C. tonsus* BRADY, and the specimen from the North Pacific is *C. plumchrus* MARUKAWA.

Female. Length, 4.83–6.32 mm; cephalothorax, 3.75 mm; abdomen, 1.08 mm; so the abdomen is contained 3.5 times in the length of the cephalothorax. The head separates from the 1st thoracic segment; the lateral corners of the last thoracic segment rounded; the rostrum with two long and slender filaments.

The abdomen 4-segmented, the joints and furca in the proportions 42:18:10:10:20=100; the genital segment inflated at the proximal lateral margins; it is slightly longer than wide (42;39); the furcal rami 2-times as long as wide.

The 1st antenna broken off in the distal joints; specimen measuring 5.90 mm had the joints in the proportional length in 0.01 mm:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
30	27	15	16	18	18	19	15	15	20	21	27	27	30	34	35	35	33.

The 2nd antenna has the endopodite about as long as the exopodite (50:48). The mandible has the exopodite 1.4 times as long as the exopodite (20:14). In the 1st maxilla the 1st inner lobe has no setae; the 2nd lobe has one or two setae; the 3rd has four long setae; the 1st outer lobe has six long setae and one short spine; the exopodite has ten setae; the distal joint of the endopodite has six setae, the 2nd joint has and 1st joint of the endopodite has four setae respectively; the 2nd basal joint has four setae. The 2nd maxilla feeble. The maxillipede soft-skinned and fairly reduced.

The 1st to 5th legs have each 3-jointed exopodite and endopodite. The outer margin of the distal joint of the exopodite of the 2nd and 4th legs is divided by the outer marginal spine into the proportional lengths 20:20, 26:21. The 5th leg has no inner marginal seta on the 1st basal joint, and the inner margin of the joint smooth; the distal joint of the endopodite bears six marginal setae; the outer margin of the 3rd joint of the exopodite is divided by the outer marginal spine in the proportional lengths 19:14.

Male. Length, 4.40–4.82 mm; the male specimen was fully described in my previous paper.

Remarks. The present specimens are larger in size than *C. tonsus* BRADY originally described by BRADY (3.60 mm). FARRAN's specimen from the South Atlantic measured 3.48–3.60 mm, and has the lateral margins of the genital segment of the female, when viewed from the dorsal is more inflated than those of the present specimen (FARRAN, 1929, fig. 12).

Occurrence. Twenty females in the vertical hauls from 1000 m to the surface in Sagami Bay, November 1937. The adult male and female have been collected also from the deep waters of the Japan Sea.

Distribution. The northern form is widely distributed in the North Pacific. The adult specimen was found in Japanese waters from the deep layers of the Pacific and the Sea of Japan.

Calanus cristatus KRÖYER

Calanus cristatus GIESBRECHT, 1892, p. 91, t. 6; VAN BREMEN, 1906, p. 10; WITH, 1915, p. 11; MORI, 1937, p. 15; TANAKA, 1938, p. 599, fig. 1, 2.

The adult specimens, both female and male, have been obtained from the deep water of Sagami Bay in October 1938. Dr. M. W. JOHNSON informed me that he had also taken the adult specimens in the cold water of the North Pacific. The immature specimens has been reported from the surface water of northern Japan. The immature specimens were found in Sagami Bay from the intermediate layers between 300–500 m, whereas the adult from the depth more than 500 m.

Calanus hyperboreus KRÖYER

Calanus hyperboreus GIESBRECHT, 1892, p. 91, t. 6, 7, 8; G. O. SARS, 1903, p. 12; MARUKAWA, 1928, p. 21; WILSON, 1932, p. 21, fig. 8; JESPERSEN, 1934, p. 34.

The species has been recorded from the northern waters of the Atlantic. MARUKAWA recorded its occurrence from the Japan Sea, but it seems to be doubtful. According to SARS, the species has been found occasionally off the Finmark coast and Lofoten Island, together with *Calanus finmarchicus*, but further southwards it appears to be wholly restricted to the great depth of the fjords. WILSON records it from the Woods Hole region and the Gulf of Maine, and further south to the Gulf Stream in winter season. JESPERSEN recorded it from the Davis Strait and Baffin Bay.

Calanus minor (CLAUS)

Calanus minor GIESBRECHT, 1892, p. 33, t. 6, 7, 8; ESTERLY, 1905, p. 126; A. SCOTT, 1905, p. 7; *Nannocalanus minor* G. O. SARS, 1925, p. 9; SEWELL, 1929, p. 20; *Calanus minor*

WILSON, 1936, 2, p. 22; FARRAN, 1936, p. 77; MORI, 1937, p. 17, pl. 5; *Nannocalanus minor*, VERVOORT, 1947, p. 26.

This species of *Calanus* has been transferred to the genus *Nannocalanus* by G. O. SARS by the fact that the head is fused with the 1st thoracic segment, and by the structure of male 4th pair of legs which differ from those of the typical *Calanus*. SEWELL recorded two forms, differing each other only in size, from the Indian waters.

Length. Female, 1.77–1.84 mm. Male, 1.50–1.56 mm.

Occurrence. The species is not so common in the Izu region. A vertical haul from 1000 m to the surface in Suruga Bay contained three adult females.

Distribution. The species has a wide distribution in the tropical and subtropical regions of the Pacific, Atlantic and Indian Oceans. In Japan it has been recorded from warm currents.

Genus *Calanoides* BRADY, 1883

The genus was separated from the typical *Calanus* by the possession of prehensile structure in the male 5th legs, and in having 4 marginal setae in the terminal joint of the endopodite of 5th leg of the female. The genus is represented by three species, *Calanoides carinatus* KRÖYER (= *brev.* LUBBOCK), *C. pathagoniensis* BRADY and *C. acutus* GIESBRECHT. One of them occurred in the present collection.

Calanoides carinatus KRÖYER

Calanus brevicornis GIESBRECHT, 1892, p. 90, t. 6, 7, 8; *Calanoides brevicornis* A. SCOTT, 1909, p. 10; TANAKA, 1937, p. 251, fig. 1; *C. carinatus* VERVOORT, 1947, p. 29, figs. 1–3.

The specimen collected was an immature female, measuring 2.75 mm. The species has been recorded from the Malayan region by A. SCOTT. CLEVE recorded it from the Indian Ocean but SEWELL failed to detect it in the "Investigator" collection.

Genus *Canthocalanus* A. SCOTT, 1909

This genus was created by A. SCOTT to accommodate a species which differs from the typical *Calanus* in the peculiar structure of the 2nd basal joint of the 1st leg, and the characters of the male 5th legs. The hook is observed on the 2nd basal joint of the 1st leg of the following four species: *Canthocalanus pauper* (GIESBRECHT), *Calanus robustior* (GIESBRECHT), *Calanus gracilis* (DANA) and *Megacalanus princeps* (WOLFENDEN). According to A. SCOTT, the hook on the 2nd basal joint of the 1st leg of *Canthocalanus* is quite different from that of the other three species, viz.: the

2nd joint is furnished with a strong, naked pyriform spine on its anterior surface; the base of this spine is only slightly attached to the surface of the joint; a considerable portion of the spines is continued upward into a distinct tooth-like process, resulting with the combination of the hook on the 1st joint, in the formation of a feeble prehensile apparatus. Further he states on the hook which is found in the 2nd basal of the 1st legs of *Megacalanus*: "This hook is quite distinct from that found in *Canthocalanus*. In *Megacalanus* the hook is a well-defined projection from the surface of the joint, and has a plumose seta articulated to it. In *Canthocalanus* the seta is transformed into a strong spine with a hooked base." A. SCOTT further emphasizes as a characteristic of *Canthocalanus* on the naked rudimentary 3-jointed endopodite of the left 5th leg of the male but this rudimentary endopodite is observed also in the left 5th leg of *Calanus robustior* GIESBRECHT. Were it sufficient reasons proposed by A. SCOTT to separate the genus *Canthocalanus* from the typical *Calanus* that the species of *Canthocalanus* has a hook and a strong spine on the 2nd basal of the 1st leg of the female, and naked endopodite on the left 5th leg of the male, one could have well transferred *Calanus robustior* into the genus *Canthocalanus*. A. SCOTT, however, included *Calanus robustior* and *C. gracilis* in the genus *Megacalanus* only on the ground that these three forms have a similar hook on the 2nd basal of the 1st leg. But he does not care the fact that in the female of *Calanus robustior* and *C. gracilis*, the head and the 1st thoracic segment are fused, and the distal spine of the terminal joint of the exopodite of the 1st leg is of peculiar shape, whereas in *Megacalanus* the head and the 1st thoracic segment are separate. Moreover, in *Megacalanus*, the distal joint of the exopodite of 2nd to 4th leg has three outer marginal spines, and the terminal spine of the 3rd joint of the exopodite of the 1st leg is of usual structure.

It seems unreasonable, as cited above, that A. SCOTT has included *C. robustior* and *C. gracilis* in the genus *Megacalanus*. They should be transferred to other genus. It is advisable to keep them in the genus *Neocalanus* proposed by G. O. SARS.

Canthocalanus pauper (GIESBRECHT)

Calanus pauper GIESBRECHT, 1892, p. 91, t. 6, 8; *Canthocalanus pauper* A. SCOTT, 1909, p. 9; *Calanus pauper* FARRAN, 1929, p. 215; *Canthocalanus pauper* SEWELL, 1929, p. 25; *Calanus pauper* FARRAN, 1936, p. 77; MORI, 1937, p. 18, pl. 6; *Canthocalanus pauper*, VERVOORT, 1947, p. 36.

Length. Female, 1.48–1.62 mm. Male, 1.40 mm.

Occurrence. The species is rare in the Izu region. Only two adult females and one male have been collected from the surface layer.

Distribution. The species has been recorded from the tropical and subtropical regions of the Pacific and Indian Oceans. In Japanese waters it has been recorded from the warm currents.

Genus *Neocalanus* G. O. SARS, 1925

Calanus robustior GIESBRECHT and *C. gracilis* DANA have been often transferred from one genus to another by different authors. A. SCOTT accommodated them in the genus *Megacalanus* WOLFENDEN on the ground that they have strong hook on the 2nd basal joint of the 1st leg. But he does not mention the absence of the peculiar terminal spine on the exopodite of the 1st leg. SARS separated these two species from the genus *Megacalanus* by the fact that in these two species the head and the 1st thoracic segment are fused, and by the features of the male 5th legs. He included these species along with *C. tenuicornis* DANA in his proposed genus *Neocalanus* without paying any attention to the presence of a strong hook on the 2nd basal joint of the 1st leg in *C. robustior* and *C. gracilis*. If it were SARS' main reason for including *C. tenuicornis* in the genus *Neocalanus* that it has the similar structure in the male 5th pair of legs to those of *robustior* and *gracilis* we had better accommodate *C. robustior* in the genus *Canthocalanus* and *A. gracilis* in the typical *Calanus*. However, the female specimen of *robustior* and *gracilis* have the similar structure in the 1st leg, and the same number of segments in the cephalothorax which differ from that of *C. tenuicornis*. It is advisable to remove *C. tenuicornis* from the genus *Neocalanus*, and keep it in the typical *Calanus*.

Neocalanus gracilis (DANA)

Calanus gracilis GIESBRECHT, 1892, p. 90, t. 1, 6, 7, 8; *Megacalanus gracilis*, A. SCOTT, 1909, p. 12; *Neocalanus gracilis* G. O. SARS, 1925, p. 7; *Calanus gracilis* FARRAN, 1929, p. 217; *Neocalanus gracilis* SEWELL, 1929, p. 26; WILSON, 1932, p. 28; *Calanus gracilis* MORI, 1937, p. 16, pl. 3, 4; *Neocalanus gracilis*, VERVOORT, 1947, p. 40.

Length. Female, 2.95–3.25 mm.

Remarks. The male of this species has the 1st thoracic segment separated from the head, and the 5th pair of legs which resemble of *C. tenuicornis* DANA, but the 1st basal joint of the left 5th leg is longer than that of the right, and the exopodite of the left leg much elongated.

Occurrence. The species is rather rare in the Izu region. It was collected by the vertical hauls from 1000 m to the surface in Sagami and Suruga Bay.

Distribution. The species has been recorded from the tropical and subtropical regions of the Pacific, Atlantic and Indian Oceans.

Neocalanus robustior (GIESBRECHT)

Calanus robustior GIESBRECHT, 1892, p. 91, t. 7, 8; ESTERLY, 129; *Megacalanus robustior* A. SCOTT, 1909, p. 13; *Neocalanus robustior* G. O. SARS, 1925, p. 8; *Calanus robustior* FARRAN, 1929, p. 217; MORI, 1937, p. 17, pl. 3, 4; *Neocalanus robustior*, VERVOORT, 1947, p. 44.

Length. Male, 3.00 mm.

Remarks. The male specimen has the 1st thoracic segment which is separated from the head. The left 5th leg of the male resembles that of *Canthocalanus pauper* in having a rudimentary 3-jointed endopodite.

Occurrence. The species is very rare in the Izu region. A single male specimen was obtained in a surface haul at Misaki in winter of 1930.

Distribution. The species has been recorded from the tropical and subtropical regions of the Pacific, Atlantic and Malay Archipelago. In Japan, it has been recorded from the warm currents.

Genus *Megacalanus* WOLFENDEN, 1904

The genus was established by WOLFENDEN in 1904 to accomodate a large copepod which he obtained from the deep water of the Atlantic, and called it *Megacalanus princeps*. The genus is distinguished from the typical *Calanus* in having a remarkable hook on the anterior surface of the 2nd basal joint of the 1st leg, and the presence of three outer marginal spines on the 3rd joint of the exopodite of the 2nd to 4th legs. In the same year SARS described the same species under the name *Macrocalanus longicornis*. WOLFENDEN (1905) added a second species of *Megacalanus* which he considered to be identical with *Calanus princeps* BRADY. So the specific name of the first form, *M. princeps*, was renamed *M. bradyi* and the name *M. princeps* was applied to the second form which is clearly not *Megacalanus*. A. SCOTT (1909) created a new genus *Bradycalanus*, and suggested that *Calanus princeps* BRADY may probably belong to his proposed genus. SARS, however, included *Bradycalanus* into *Megacalanus* on the ground that these genera differ only in the presence or absence of a hook on the 2nd basal joint of the 1st leg. The genus *Megacalanus* proposed by SARS is, at present, generally accepted, and the genus comprises three species: *M. princeps* WOLFENDEN, *M. sarsi* FARRAN, which is identical with *Macrocalanus princeps* SARS 1905, and *M. typicus* (A. SCOTT). One of them appeared in the collection.

Megacalanus princeps WOLFENDEN

(Fig. 3, *a-d*)

Megacalanus princeps A. SCOTT, 1909, p. 13, pl. 1; *M. longicornis* SARS, 1925, p. 14, pl. 3; SEWELL, 1929, p. 27; *M. princeps* VERVOORT, 1947, p. 49, fig. 4.

Female. Length, 10.34 mm; cephalothorax, 18.15, abdomen, 2.19 mm; the cephalothorax elongate ovate; the lateral corners of the last thoracic segment triangularly produced; the rostrum consists of two strong spines.

The abdomen 4-segmented; the segments and furca in the proportions 41:20:15:7:17=100; the furcal rami slightly longer than wide.

The 1st antenna 25-jointed, exceeds the end of the furca by terminal nine joints. The mouth parts as those of the genus *Calanus*. The maxillipede is furnished with stiff hairs on the middle part of the 1st basal, and on the proximal half of the 2nd basal joint.

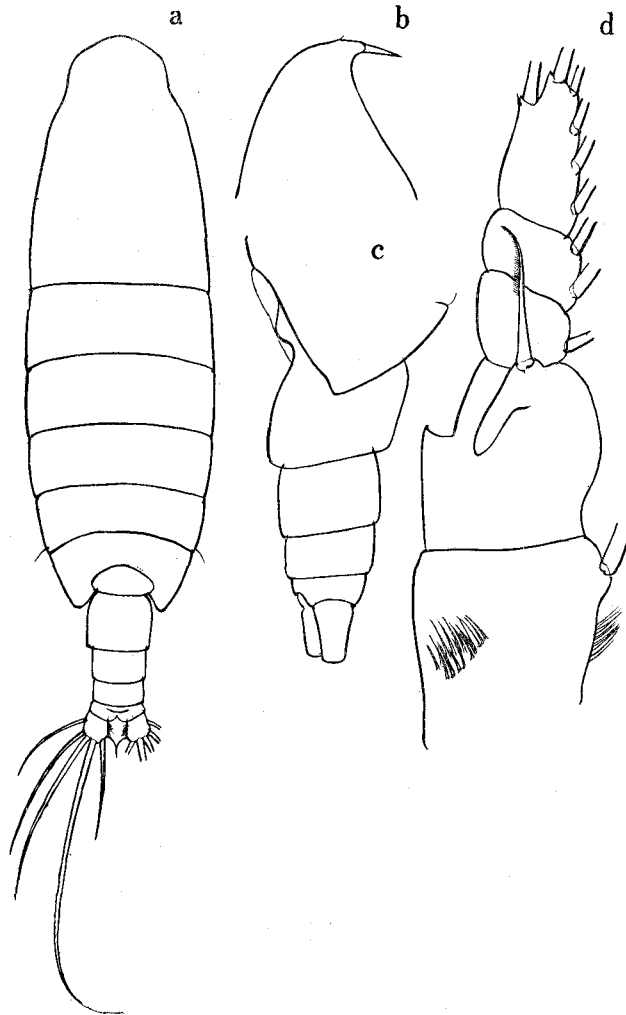


Fig. 3. *Megacalanus princeps* WOLFENDEN.

a, Female, dorsal aspect; b, head, lateral aspect; c, last thoracic segment and abdomen, lateral aspect; d, basal joints and endopodite of 1st leg.

The 1st to 5th legs have each 3-jointed exopodite and endopodite. There is a prominent hook on the 2nd basal joint of the 1st leg at the junction with the endopodite. The outer margin of the 3rd joint of the exopodite of the 2nd to 4th legs has

three spines. The 5th leg has two outer marginal spines on the 3rd joint of the exopodite.

Remarks. *Pseudolovenula magna* MARUKAWA is, according to VERVOORT, identical with the present species.

Occurrence. Five female specimens from the deep waters of Sagami and Suruga Bay.

Distribution. The species has wide distribution in the deep waters of the Pacific, Atlantic, and Indian Oceans.

Genus *Bradycalanus* A. SCOTT, 1909

A. SCOTT created the genus *Bradycalanus* to accomodate the species which resembles closely *Megacalanus* WOLFENDEN. His genus is distinguished from the latter by the densely plumose spine on the apex of the 2nd maxilla, and by the absence of the hook on the anterior surface of the 2nd basal joint of the 1st leg. The other appendages are as those in *Megacalanus*. SARS merged the genus *Bradycalanus* into *Megacalanus* in his monograph of 1925. The genus *Bradycalanus* is represented by a single species *B. typicus* A. SCOTT. VERVOORT recorded the species in the Snellius Expedition under the name *Megacalanus typicus*. No example of the genus has been met with in the present collection.

Genus *Bathycalanus* G. O. SARS, 1905

The genus was created by SARS to accomodate a single species, *B. richardi*, which was obtained from the Atlantic. The genus *Bathycalanus* differs from *Megacalanus* WOLFENDEN in the peculiar armature of the frontal part of the head, and in the structure of the maxillae and maxillipede, and the 1st pair of legs. The 1st leg has no hooked process on the 2nd basal joint, and the exopodite is composed of two joints.

At present three species, *B. richardi* SARS, *B. bradyi* WOLFENDEN (= *Megacalanus bradyi* WOLFENDEN, 1905) and *B. princeps* (BRADY) (= *Calanus princeps* BRADY, 1883) have been reported. SEWELL recorded *B. richardi* SARS from the Indian Seas. VERVOORT recorded three species in the Snellius Expedition. But no example of the genus has been met with in the Izu region.

Genus *Undinula* A. SCOTT, 1909

The genus was named by A. SCOTT to accomodate some species of *Calanus* which exhibit a considerable difference in the structure of the male 5th pair of legs. The female of the genus differs very little in the structure of the appendages from typical *Calanus*. The genus, at present, comprises two species, *U. darwini* (LUBBOCK) and *U. vulgaris* (DANA). Both of them appeared commonly in the Izu region.

Undinula darwini (LUBBOCK)

Calanus darwini GIESBRECHT, 1892, p. 91, t. 6, 7, 8; *Undinula darwini* A. SCOTT, 1909, p. 17; FARRAN, 1929, p. 217; SEWELL, 1929, p. 42; FARRAN, 1936, p. 78; *Calanus darwini*, MORI, 1937, p. 18, pl. 5; *Undinula darwini*, VERVOORT, 1947, p. 77.

Length. Female, 2.13–2.56 mm. Male, 1.93–2.1 mm.

Remarks. SEWELL divided the female specimen into three forms: forma *typica*, forma *typica* var. *symmetrica*, and forma *typica* var. *intermedia*; the present specimen is identical with forma *typica*, but the posterior margin of the thoracic segment is not produced on the right side as figured by SEWELL.

Occurrence. The species is one of the most common surface-living one in the Izu region.

Distribution. The species is widely distributed in the warm waters of the Pacific, Atlantic and Indian Oceans.

Undinula vulgaris (DANA)

Calanus vulgaris GIESBRECHT, 1892, p. 92, t. 6, 7, 8; *Undinula vulgaris* A. SCOTT, 1909, p. 18; *Calanus vulgaris* FARRAN, 1929, p. 216; *Undinula vulgaris* SEWELL, 1929, p. 81; WILSON, 1932, p. 29; FARRAN, 1936, p. 77; *Calanus vulgaris* MORI, 1937, p. 19, pl. 5, 6; *Undinula vulgaris* VERVOORT, 1947, p. 72.

Length. Female, 2.75–2.81 mm. Male, 2.31–2.69 mm.

Remarks. MORI (1937) recorded an abnormal specimen with branched furcal setae which had previously been described as *Calanus orientalis* by MARUKAWA (1908).

Occurrence. The species is one of the most common surface-living copepod of the Izu region; it is abundant in summer season.

Distribution. The species has a wide distribution in the warm regions of the oceans.

Family EUCALANIDAE

Genus *Eucalanus* DANA, 1848

Eight species belonging to the genus have been recorded from the Japanese waters, namely: *E. attenuatus* (DANA), *E. elongatus* (DANA), *E. crassus* GIESBRECHT, *E. mucronatus* GIESBRECHT, *E. pileatus* GIESBRECHT, *E. subcrassus* GIESBRECHT, *E. subtennis* GIESBRECHT and *E. giesbrechti* MORI; all of them occurred in the present collection. Beside these, *E. bungii californicus* JOHNSON was found from the deep water of Suruga Bay. It has been reported by GIESBRECHT that there are three varieties of *Eucalanus elongatus* DANA: var. *hyalinus*, var. *inermis* and var. *bungii*; of these, *hyalinus* is the Atlantic form. According to Dr. M. W. JOHNSON var. *hyalinus* and var. *inermis* are the tropical or sub-tropical variant and var. *bungii* is the boreal variant of the Pacific. Of these three varieties, var. *bungii* has been obtained abundantly in the North-East

Pacific; var. *inermis* and var. *hyalinus* in small number off the coast of California. He, after studying the developmental stages and the geographical distribution of these varieties, raised var. *bungii* and var. *inermis* to specific rank. Moreover, he established a new subspecies of var. *bungii* which is the southern form of var. *bungii*, and named *E. bungii californicus*. Of these variants, I have recorded the occurrence of var. *bungii* from the surface water of Sagami Bay in winter season, but the occurrence of var. *bungii californicus* has not been known until the deep water hauls in Suruga Bay caught it in the collection. Nine species, in all, have been obtained in the present material; they appear to be the warm water inhabitant except *E. bungii bungii* and *E. bungii californicus*.

According to SEWELL, *Eucalanus acus* FARRAN, taken in the south of New Zealand, is synonym of *E. longiceps* MATHEWS which had been collected in the Indian Seas. SEWELL recorded the occurrence of eight species from the Indian Seas, namely, *E. attenuatus*, *E. elongatus*, *E. crassus*, *E. longiceps*, *E. monachs*, *E. mucronatus*, *E. pileatus*, and *E. subcrassus*. A. SCOTT recorded also six species with the exception of *E. attenuatus* and *E. elongatus*. VERVOORT recorded seven species in the Snellius Expedition. He is of opinion that JOHNSON's species of *E. elongatus* has no specific value.

Eucalanus attenuatus (DANA)

(Fig. 4, a-d)

Eucalanus attenuatus GIESBRECHT, 1892, p. 131, t. 3, 11, 35; ESTERLY, 1905, p. 133; G. O. SARS, 1925, p. 78; FARRAN, 1929, p. 218; SEWELL, 1929, p. 47; WILSON, 1932, p. 32; TANAKA, 1935, p. 145, pl. 11; MORI, 1937, p. 22, pl. 8; FARRAN, 1936, p. 78; VERVOORT, 1947, p. 95.

Length. Female, 4.32-4.43 mm, Male, 3.24-3.42 mm.

Occurrence. Very common in the surface and deep layers.

Distribution. The species is widely distributed in the Pacific, Atlantic and Indian Oceans.

Remarks. Among the specimens of *E. attenuatus* DANA taken in winter season from Sagami Bay, there occurred often large individuals which differ slightly from the typical *E. attenuatus* in the proportional lengths of the joints of the male 5th pair of legs (fig. 4 b). The specimen measured 4.76 mm in the female, and 4.40-4.54 mm in the male.

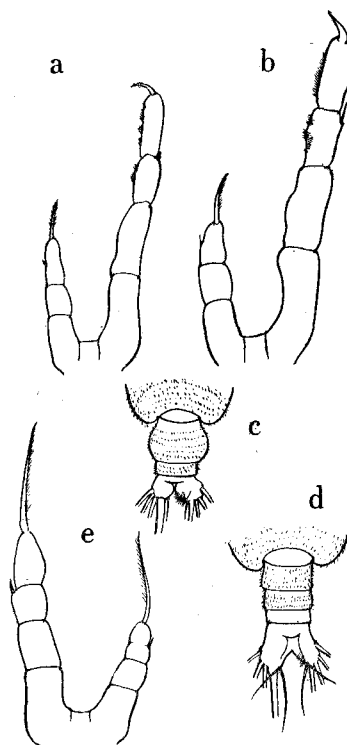
There is another form of *E. attenuatus* which differs either of them above stated in the following: the genital segment of the female is wider than long (fig. 4 c); the thoracic segments and the 1st to 2nd abdominal segments are covered with fine short hairs; this specimen measured 5.72-6.19 mm in the female, and 4.50-4.67 mm in the male of 5th copepodid stage (fig. 4 d, e).

These specimens were taken mixed with the typical form of *E. attenuatus* in winter 1930, from the surface water of Sagami Bay; they may perhaps be the nor-

thern varieties of *E. attenuatus* (DANA).

Fig. 4. *Eucalanus attenuatus* (DANA).

a, Male: 5th pair of legs of the type specimen; *b*, 5th pair of legs of large specimen, measuring 4.40–4.54 mm; *c*, female: abdomen of large specimen; *d*, male: juv. larger specimen, abdomen, dorsal aspect; *e*, 5th pair of legs.



Eucalanus elongatus (DANA)

Eucalanus elongatus GIESBRECHT, 1892, p. 131, t. 11, 35; G. O. SARS, 1925, p. 20; FARRAN, 1929, p. 218; SEWELL, 1929, p. 48; WILSON, 1932, p. 31; TANAKA, 1935, p. 143, pl. 1; FARRAN, 1936, p. 78; MORI, 1937, p. 21, pl. 7; VERVOORT, 1947, p. 84.

Length. Female, 5.62–5.76 mm. The specimen has laterally produced thoracic margins, and is slightly spinulated on the dorsal surface. The 1st leg has an internal setae on the 2nd basal joint.

Occurrence. The species has been obtained both from the surface and deep waters in small quantity.

Distribution. The species has wide distribution in the Pacific, Atlantic and Indian Oceans.

Eucalanus bungii var. *bungii* (JOHNSON)

Eucalanus elongatus var. *bungii* GIESBRECHT, 1892, p. 149; SATO, 1913, p. 2; *Eucalanus elongatus* var. *bungii* TANAKA, 1935, p. 143, pl. 1; *Eucalanus giesbrechti* MORI, 1937, p. 22, pl. 7; *Eucalanus bungii bungii* JOHNSON, 1938, p. 167, figs. 4–10, 18, 20, 23, 25; *Eucalanus elongatus* VERVOORT, 1947, p. 84.

Length. Female, 6.30 mm. Male, copepodid stage V, 5.50 mm.

Remarks. This species is easily distinguished from *E. elongatus* by the rounded corners of the 5th thoracic segment, and by the presence of three setae on the 2nd basal joint of the mandible. MORI raised the species to the rank of species under the name *E. giesbrechti*. JOHNSON revised it as *E. bungii bungii*, a subspecies of *E. bungii*. VERVOORT advises to distinguish two forms in *E. elongatus*: the Pacific form with smoothly rounded lateral thoracic margins, symmetrical 1st antennae and without any indication of spinules on the dorsal surface and, the Atlantic form with produced thoracic margins, asymmetrical 1st antenna and spinulated dorsal surface. But in my opinion it is better to distinguish the former with rounded thoracic margins from the latter with produced thoracic margins under the name *E. bungii*. The present specimen, *E. bungii* var. *bungii*, is the northern variety of *bungii*.

Eucalanus bungii var. *californicus* (JOHNSON)

(Fig. 5, a-d)

Eucalanus elongatus ESTERLY, 1905, p. 131.

Eucalanus bungii californicus JOHNSON, 1938, p. 169, fig. 22.

Remarks. This species agrees with *E. elongatus* var. *bungii* GIESBRECHT except that the 2nd basal of the mandible is furnished with a single seta. According to JOHNSON, *E. bungii* var. *bungii* is a northern variety of *E. elongatus*, and *E. bungii californicus* is a southern variety of *E. bungii* which is common in the California coast. According to JOHNSON, *E. elongatus* ESTERLY is identical with the present species. JOHNSON elevated this species to the rank of subspecies, but it seems reasonable to keep the subspecies as a variety.

Length. Female, 6.18 mm, cephalothorax, 5.62 mm, abdomen, 0.56 mm. The cephalothorax elongate oval, produced narrowly anteriorly. The abdomen is contained 10-times in the length of the cephalothorax; the abdomen 3-segmented, the segments and the furca in the proportions 47:18:12:23=100; the furcal rami slightly asymmetrical.

The 1st antenna exceeds the end of the furca by terminal two or three joints. The 2nd antenna has 8-jointed endopodite; the 1st and 2nd basal joints of the exopodite are of equal lengths. The mandible has a slender 2nd basal joint which is furnished with one seta on the proximal inner margin; the exopodite is situated about the middle of the 2nd basal joint. The maxillae and maxillipede are as those of *E. elongatus* (DANA).

The 3rd joint of the exopodite of 1st leg has two outer marginal spines. The 2nd to 4th legs as those of *E. elongatus*.

Occurrence. The species has been collected, only in small numbers, from the deep water of Suruga Bay, but not a single specimen from Sagami Bay.

Distribution. The specimen has been recorded only from the California coast.

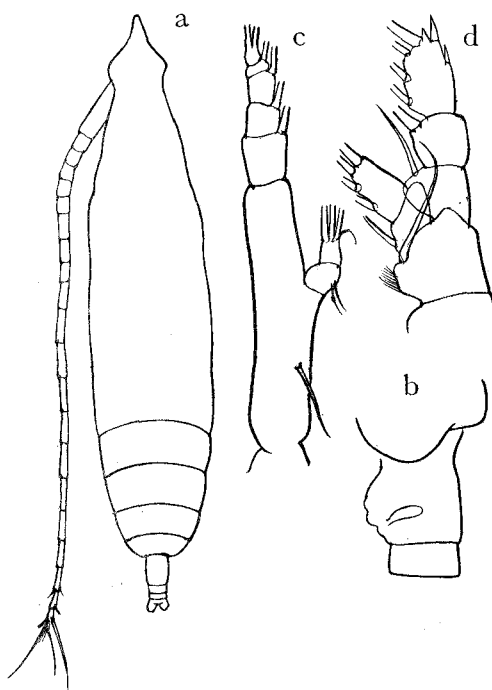


Fig. 5. *Eucalanus bungii* var. *californicus* (JOHNSON).
 a, Female, dorsal aspect; b, last thoracic segment and genital segment, lateral aspect; c, mandible; d, 1st leg.

Eucalanus crassus GIESBRECHT

Eucalanus crassus GIESBRECHT, 1892, p. 132, t. 11, 35; ESTERLY, 1905, p. 134; A. SCOTT, 1909, p. 19; WITH, 1915, p. 53; SARS, 1925, p. 22; FARRAN, 1929, p. 220; SEWELL, 1929, p. 50; FARRAN, 1936, p. 78; TANAKA, 1935, p. 145, pl. 5; MORI, 1937, p. 23, pl. 9; VERVOORT, 1947, p. 112; *E. ocularus* MARUKAWA, 1921, p. 7.

Length. Female, 3.17–3.73 mm. Male, 3.13–3.49 mm.

Occurrence. Common in the surface water.

Distribution. The species is widely distributed in the warm regions of the oceans.

Eucalanus mucronatus GIESBRECHT

Eucalanus mucronatus GIESBRECHT, 1892, p. 132, t. 11, 35; A. SCOTT, 1909, p. 20; G. O. SARS, 1925, p. 21; FARRAN, 1925, p. 218; TANAKA, 1935, p. 147, pl. 3; FARRAN, 1936, p. 78; MORI, 1937, p. 25, pl. 8; VERVOORT, 1947, p. 104.

Length. Female, 3.13–3.49 mm.

Occurrence. Rather rare; the male specimens were all immature.

Distribution. The species has a wide distribution in the warm regions of the oceans, but according to SEWELL the species is not common in the Indian Ocean.

Eucalanus pileatus GIESBRECHT

Eucalanus pileatus GIESBRECHT, 1892, p. 132, t. 11, 35; A. SCOTT, 1909, p. 21; WOLFENDEN, 1911, p. 204; SEWELL, 1929, p. 51; TANAKA, 1935, p. 148, pl. 4.

Length. Female, 2.11–2.41 mm. Male, 2.16 mm.

Occurrence. Rather rare.

Distribution. The species has been recorded from the Pacific, Atlantic, Malay Archipelago, Maldiva Archipelago and Indian Ocean.

Eucalanus subcrassus GIESBRECHT

Eucalanus subcrassus GIESBRECHT, 1892, p. 132, pl. t. 11, 35; A. SCOTT, 1909, p. 21; FARRAN, 1929, p. 219; SEWELL, 1929, p. 51; TANAKA, 1935, p. 51, pl. 4; FARRAN, 1936, p. 75; MORI, 1937, p. 24, pl. 9; VERVOORT, 1947, p. 108.

Length. Female, 2.77–2.82 mm. Male, 2.52 mm.

Occurrence. Rare.

Distribution. The species is widely distributed in the tropical and subtropical regions, and has been recorded from the Atlantic, Indian Oceans, Malay Archipelago and Great Barrier Reef.

Eucalanus subtenuis GIESBRECHT

Eucalanus subtenuis GIESBRECHT, 1892, p. 132, t. 11, 35; ESTERLY, 1905, p. 135; MARUKAWA, 1908, p. 6, pl. 1, 2; A. SCOTT, 1909, p. 21; G. O. SARS, 1925, p. 21; FARRAN, 1929, p. 218; TANAKA, p. 147, pl. 3; MORI, 1937, p. 25; VERVOORT, 1947, p. 106.

Length. Female, 3.22–2.40 mm. Male, 3.06–2.63 mm.

Occurrence. One of the most common species.

Distribution. The species has been recorded from the Pacific, Atlantic, Mediterranean Sea, and Malay Archipelago; but the occurrence of the species has not been recorded from Indian Ocean.

Genus *Rhincalanus*, DANA, 1848

Three species belonging to this genus have been recorded from the Japanese waters: *Rhincalanus cornutus* DANA, *R. nasutus* GIESBRECHT and *R. gigas* BRADY. The last species has been described by MARUKAWA (1908) from the immature specimen taken from the surface waters off the coast of the Prov. Izu. His figures are, as pointed out by SCHMAUSS, uncertain. He described that the specimen is a female, measuring 7.8–9.0 mm in total length; but the figure (Fig. 59) given as the 5th pair of legs,

indicates that the specimen is not female at all, but an immature male; the 2nd to 4th thoracic segments have each a pair of dorsal and lateral spines and dorsal spines on the 1st abdominal segment. The immature male specimen of *R. gigas* has the lateral spines on the 3rd and 4th thoracic segment, and dorsal spines only on the 4th thoracic and on the 1st abdominal segment. MARUKAWA's figure of the 5th pair of legs agrees those of *R. gigas* or *R. nasutus*, in having a long endopodite on the left leg. His specimen differs from *R. gigas* in the spinulation of the thoracic segments which is the sufficient reason for identifying the both species. His specimen measures about 3.2–5.4 mm, calculating from the magnification of the microscope used, and from the figures of the entire body of the other species on the same plate. Again considering the geographical distribution of *R. gigas*, it is confined to the Antarctic water south of Lat. 37° S; the occurrence of the species in the upper layer of the northern temperate region seems very doubtful. SCHMAUSS identified MARUKAWA's specimen as *R. cornutus* forma *typica*; perhaps for the reasons that the specimen has both lateral and dorsal spines on the 2nd thoracic segment; but the shape of the forehead quite differs from that of *R. cornutus* in MARUKAWA's specimen. *R. nasutus* in Japanese waters has both lateral and dorsal spine on the 2nd thoracic segment. From the reasons above stated, MARUKAWA's specimen is the immature male of *R. nasutus* which is common in Japanese waters.

Rhincalanus nasutus GIESBRECHT

Rhincalanus nasutus GIESBRECHT, 1892, p. 132, t. 3, 9, 12, 35; G. O. SARS, 1903, p. 18; ESTERLY, 1905, p. 136; *R. gigas* MARUKAWA, 1908, p. 3, pl. 2, figs. 49–59; A SCOTT, 1909, p. 24; SCHMAUSS, 1927, p. 368; FARRAN, 1929, p. 220; SEWELL, 1929, p. 58; WILSON, 1932, p. 34; TANAKA, 1935, p. 151; FARRAN, 1936, p. 79; MORI, 1937, p. 26, pl. 10; VERVOORT, 1949, p. 122.

Length. Female, 3.60–4.50 mm. Male, 3.74–3.81 mm.

Remarks. The specimen from the Japanese waters has both lateral and dorsal spines on the 2nd thoracic segment.

Occurrence. Common. It is rather abundant in the deep layers.

Distribution. The species has a wide distribution in the oceans.

Rhincalanus cornutus DANA

Rhincalanus cornutus GIESBRECHT, 1892, p. 153, t. 12; A. SCOTT, 1909, p. 32; G. O. SARS, 1925, p. 22; SCHMAUSS, 1927, p. 359; FARRAN, 1929, p. 220; SEWELL, 1929, p. 58; WILSON, 1934, p. 35; TANAKA, 1935, p. 151; FARRAN, 1936, p. 79; MORI, 1937, p. 27, pl. 10; VERVOORT, 1947, p. 116.

Length. Female, 3.24–3.63 mm.

Remarks. The specimen agrees well with description and figures of *R. cornutus* f. *typica* given by SCHMAUSS. The male specimens were all immature in the 5th copepodid stage.

Occurrence. Common in the surface layer.

Distribution. The species has a wide distribution in the oceans.

Genus *Mecynocera* THOMPSON, 1888

Mecynocera clausi THOMPSON

Mecynocera clausi GIESBRECHT, 1892, p. 160, t. 5, 11, 35; THOMPSON, 1894, p. 80; ESTERLY, 1905, p. 137; SARS, 1925, p. 23; FARRAN, 1929, p. 221; SEWELL, 1929, p. 60; WILSON, 1932, p. 36; TANAKA, 1935, p. 152, p. 4; FARRAN, 1936, p. 79; MORI, 1937, p. 28, pl. 11, 12.

Female. Length, 0.94–0.99 mm.

Occurrence. Common species in the surface layer.

Remarks. The adult male specimen has not been met with in Japanese waters. It has been recorded from the Gulf of Guinea. The male 5th legs have been described as follows: "The 5th pair are one-branched, alike on both sides and in both sexes; basal portion two-jointed; not much stouter than the terminal portion which is three-jointed. There is, so far as could be observed, no terminal spine."

Distribution. The species is of a wide distribution, and has been recorded from warm waters of the oceans.